LETTERS TO THE EDITOR.

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Contemporary Meteor-Showers of the Leonid and Bielid Meteor-Periods.

Part II.—Co-Bielid Showers.

AMONG nearly 120 meteor-tracks of the period November 20th–30th, partly seen here in recent years, and partly drawn from the Reports of the Luminous Meteor Committee of the British Association, of the years 1861–80, and among a list of 100 *Bielid*-period meteor-paths observed in Italy, as will be further illustrated and more especially described below, on November 19th–30th, 1897, there were found to have occurred, in this long-past years' collection, 30 *Bielid* meteors and 188 unconformable or ordinary *non-Bielid* meteor-tracks. Several of the former meteors were recorded before the startling discovery in 1872, of the swarm of meteors connected with Biela's comet, had made known the existence of a focus of cometary *Bielid* meteors in this period near γ *Andromedae*; so that several evidently *Bielid* meteors of the list had never before had their true radiant-point, near γ, τ *Andromedae* assigned to them. The great body of *Bielid*-tracks having been subtracted, and the remaining 188 ordinary meteor-paths projected on a planisphere stream of η *Taurids* at about 56°, + 18°,[1] this central shower of *Taurids* shows an almost cometary strength and stability of display, approaching in yearly constancy, although not at all in profusion of its meteors, to the showers of August *Perseids*. It produces, moreover, about the middle of November, a notable number of large meteors, and even, as has been proved in one case at least, also detonating fireballs. Its marked superiority over all the showers contemporary with it, only excepting that of the *Bielids*, is easily seen by the slow gradation and comparative smallness of the meteor-frequencies noted in the Table for the next most steady and productive showers. But all these latter streams also considerably outshone the great bulk of weaker streams marked by much fewer numbers of satisfactorily assorted tracks; and their six or seven especially productive *foci* would no doubt, among many showers of very variously interesting and eminent importance in the contemporary List, abundantly repay, in coming years, some further study. To assist discussions by projections of any such new observations, a few less productive radiant-points of Mr. Denning's *Leonid-Bielid* Period List, may even, perhaps, be here mentioned with advantage, although they each furnished no more than four independent meteor-tracks, or 2 per cent. of all the ordinary meteors' paths collected and compared together in the mapped collection.

Taking their numbers and positions as before from Mr. Denning's list of fifty contemporary showers of the *Leonid-Bielid* period, and adding in numbers and mean positions, D('99), of a few shower-series from his extensive General Catalogue of 1899, the following were the recognised centres of divergence

TABLE IV.—*Relative abundances of meteors from different ordinary Meteor-showers in the* Bielid *Period, November 20th–30th, among* 188 *ordinary and* 30 Bielid *shooting-stars mapped in some* non-maximum Bielid *nights of the years* 1861-97; *and relative frequency of the* Bielid *meteors.*

Radiant-point's Number and positon in Denning's *Co-Leonid* List.	[25°+42°, γτ *Andromedae.*] *Bielids.*	13; 63°+21° εω *Tauri.*	11; 60°+28 ζ *Persei.*	18; 77°+32° ιχ *Aurigae.*	17; 74°+15° *y Orionis.*	7; 46°+21° εζ *Arietis.*	26; 110°+25° δικ *Geminorum.*	28; 124°+55° *k Lyncis.*
Numbers of the Shower's Meteors per 100 of all *Non-Bielid* Meteors.	16	12	5 Seen only in 1897.	4½	4½ Seen only in 1897.	3½	3½	2½ Not seen in 1897.
General Appearances of the Showers' Meteors.	Bright, orange yellow, slow; very bushy and spark-tailed; no streaks.	Bright, yellowish meteors; sometimes spark-tailed.	Small, yellowish meteors, with spark-tails.	Yellowish, white; slightly tailed or streaked.	Moderately swift and bright; no streaks.	White or yellow, tailed; rather bright and slow.	Bright, white, swift; with pretty persistent streaks.	Swift, tapered, brushy meteors, leaving streaks.

containing all the fifty radiant-points for the *Leonid-Bielid* period, of Mr. Denning's Select List, the paths of all these meteors, without any outstanding very refractory or certainly irreducible exceptions, were found to be satisfactorily referable by trueness of direction joined to suitable descriptions, to one or other of the many radiant-points contained in Mr. Denning's List.

Relative numerical strengths could thus be assigned to many of the fifty contemporary showers, expressing the numbers of meteors traced truly and suitably back to all the best distinguished active sources, among about 30 more or less exactly corroborated radiant-centres. For simplicity the numbers of such meteors per hundred of all the 188 projected ordinary meteor-tracks are noted, to show their relative numerical intensities, against the seven most active of the thus detected ordinary showers which are presented, in descending order of meteor-density or shower-vigour, in the accompanying Table. The percentage strength of the *Bielid* shower itself, which is introduced for comparison with the less productive meteor-systems, is reckoned on the same scale of proportion, to the total number of *non-Bielid* meteors, with that of the slenderer displays, and it only insignificantly outshone the brightest of those contemporary meteor-streams, from no observations having happened to be made, in this collection, in any of the years when the *Bielid* meteor-showers was at a maximum.

The ε *Taurid* shower, at 63°, + 21°, stood nearly as high as the *Bielid* stream itself, in marked abundance of its meteors. Together with an apparently distinct, but perhaps associated of eleven weaker showers (or sometimes of small groups of showers) each contributing about one in every fifty of the whole projected number of ordinary meteor-paths.

1	9° + 34°, π *Andromedae*	seen, almost entirely in 1897.
D('99)39	44 + 57, η *Persei*	
8	48 + 43, βκ *Persei*	
14	70 + 66, *c*, or α *Camelopardi*; scarcely seen in 1897.	
	And nearer the equator,	
D('99)273	253 + 4, ι *Piscium.*	
D('99)3 and 11	9 + 9 γ *Pegasi* and ε *Piscium.*	
5	30 + 16, α *Arietis*	chiefly seen in 1897.
6	43 + 6, α *Ceti*	
D('99)49	53 + 8, *e* or ξο *Tauri* (three tracks only),	
32	136 + 8, ζ *Hydrae*; not seen in 1897.	

[1] A good display of meteors of this shower was seen this year by Mr. W. E. Besley, at Clapham Park, S.W., on November 8th. Seven bright meteors (and another of 1st magnitude on November 10th), were noted in the short space of 1h. 48m., ending at 12h. 46m. on that night, with a very well-defined radiant-point at 52°, + 22°. Their apparent magnitudes in the fixed-star scale were, 4, 2, 1, 1, 3, 2, 1½, 1, and they were long-pathed, slow, trained meteors. Two of the brightest, at 11h. 26m. and 11h. 33m., on November 8th, showed pale green colour in the heads. The meteors of the showers near η *Tauri*, at 56°, + 18°, it should be noticed, are chiefly observable in the first half of November, and reach a well-marked maximum of abundance on November 6th–10th; while the ε *Taurids*, at 63°, + 21°, have an equally distinct date of maximum on about November 20th, and are usually seen in greatest numbers in the last half of November.

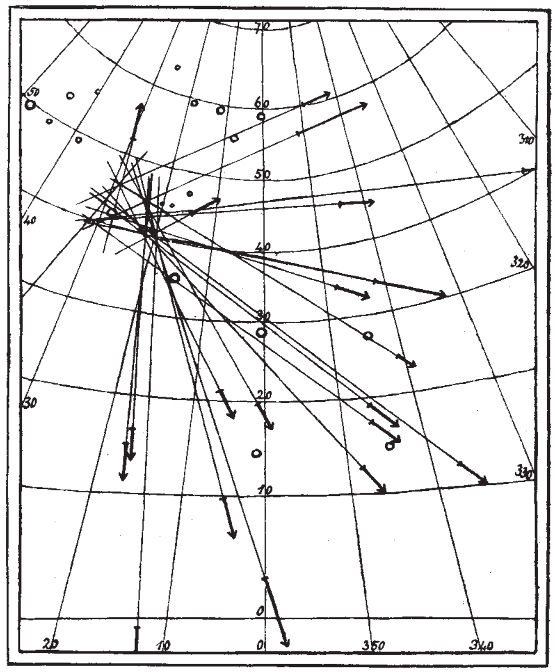
The *Bielid* meteors numbered only about $\frac{1}{8}$th, and the *Taurids* about $\frac{1}{8}$th, of the number of ordinary, or *non-Bielid* shooting-stars; and of the latter divers-centred meteors, the above seven greater and ten lesser ordinary showers supplied together about $\frac{3}{8}$ths of the whole meteor number. At the rate of frequency of shooting-stars on ordinary November nights, of about six or seven per hour, it is evident that on such nights, watches would ordinarily have to be continued for six or eight hours to obtain a sufficiently copious path-register of six or seven *Bielid* or *Taurid* shooting-stars, for determining their radiant-points' positions with exactness; and for the less productive showers of which the six stronger and nine weaker ones of the above lists furnished on an average only four and two per cent. of the sundry-centred meteors, watches to record the same numbers of their flights would in general have to be maintained for 25 or 50 hours on successive clear November nights. But as the *Bielid* shower betrays, no weight sufficient to deter observers from attentive watches for them should be attached to most of these showers' low average productivenesses, because they usually appear in sudden rushes of more or less abundant profusion, on no very fixed dates of apparition. Such a marked example of sudden change of strength, seen actually in a single night, appears to have presented itself this year in the *Taurid* meteor-stream, during the preliminary watches kept in the beginning of November for possible forerunners of a coming shower of *Leonids*. No later vestiges at all of the brief shower of seven bright *η Taurids* seen in his watch by Mr. Besley between 11 h. and 13h. on November 8th,[1] were noticeable here in my 2 hrs. watch after 13 h. 40 m. on that night. Only one meteor's path seen here, an exactly true *ξ Taurid*, but 4° distant in its direction from the point near *η* Tauri, among the eighteen meteors mapped in clear sky during those two hours, proceeded backwards from any focal region nearer than 10°–15° to *η Tauri*; and no signs of even diffuse radiation from a considerable space round the shower's radiant-point near *η* Tauri, were shown among the 46 meteor-paths recorded here in my earlier and later watches of $2\frac{1}{2}$–3 hrs. each, on the nights of November 6th and 10th; so that this shower of remarkably bright meteors must certainly, it appears, have been a pretty conspicuous one of very brief duration.

Nor must it be expected that the same showers will be visible every year, in the same strengths, or in the same relative strengths to one another. Such changeful phases of appearance and non-appearance of showers in different years, were well exemplified in the present shooting-star survey, by a fact of great value and help to the collection, that nearly half of its meteor-tracks (100 paths) were observed in a single fortnight of November, 1897, under the clear sky of the Riviera Coast of Italy, by my nephew, Mr. J. A. Hardcastle, who also reduced his own observations and sorted them under their several radiant-points. It thus happens that the radiants marked in the above two lists, of main showers, and of less prominent *addenda*, as only, or chiefly seen in 1897, were not distinguished by more than one meteor, at most, among the earlier set of English observations (the *γ Orionids*, *ζ*, *η* and *κ Perseids*, *α Arietids*, *α Cetids*, and *π Andromedes*); and that on the other hand the *c Camelopardids*, *k Lyncids* and *ζ Hydrids* were scarcely seen at all in November, 1897; while the remaining radiant-points, *γ Andromedae*, *ε Tauri*, *δ Geminorum*, *ι Aurigae*, *ε Arietis* and *ο Tauri*, *γ Pegasi* and *Piscis*, presented themselves about equally in both the lists.

To correspond with the *ε Taurids*, so plentifully visible on these *Bielid* nights, only a branch shower, apparently, of this main *Taurid* stream, at 68°, + 17°, was noted here, this year, in the beginning of November; and only one (doubly observed) meteor then was recognised as belonging to the active *co-Bielid* meteor-centre near *ι Aurigae*. Similarly a well-focused flight of ten *ο Taurids* among 64 ordinary meteors of the earlier watch, produced among about thrice as many ordinary *co-Bielid* meteors, only three meteors from the same radiant-point; and these few distinctions rather than likenesses between the two periods' showers, were the only examples which occurred of either identity or general resemblance in the two periods' stream-directions. But since they all, or nearly all, formed part of a well established contemporary shower list for the middle of November, frequently renewed, well sorted observations would no doubt disclose many distinct continuities of the same ordinary showers from one meteor-period in November to the other, just as the radiant-points extracted for the *Bielid* period from a long series of years were found to agree distinctly in a considerable number of cases, with those recorded in a single year.

Twenty-one *Bielid* shooting-stars were among the 100 meteors mapped at Alassio in November, 1897; and in a projection of his observations which was then made by Mr. Hardcastle on one of Prof. Lorenzoni's gnomonic polar nets, these are shown in the adjoining map, diverging from near *τ*, *υ* and *γ Andromedae*. Of the two maxima of frequency or of hourly rate of appearance, shown at the foot of the map, which they seem to have presented on November 23rd and 26th, the first agrees closely with the date of the shower's last bright return on November 24th, 1892; while the second seems to be a still-lingering remnant of the older date of the stream's returns, on November 27th, in 1872 and 1885, before the meteor-cluster's node was shifted backwards 4°, as Dr. Bredichin has proved, by

Paths of 21 Bielid Meteors observed at Alassio, Italy, November 19th–27th, 1897, by J. A. Hardcastle.



Dates, 1897, November	19	20	22	23	24	25	26	27
Duration of Watch, in clear sky	2h.	2h.	3h.	$2\frac{1}{2}$h.	3h.	$\frac{3}{4}$h.	$1\frac{1}{2}$h.	2h.
Numbers of Bielids mapped ...	1	3	4	5	3	1	3	1
Numbers of Bielids per hour ...	0·5	1·5	1·3	2·0	1·0	1·3	2·0	0·5

strong attractions of the planet Jupiter on the meteor-swarm in the year 1890. No large action of Jupiter on the swarm, it has been shown by the late Dr. Abelmann,[1] would afterwards occur again until the year 1901, when another near approach of the cluster to the giant planet will shift the node backwards 6°, and make the date of the shower's next expected great return November 17th, 1894 or 1895. On the two occasions of the earth's passage through the node on November 23rd or 24th, in 1898 or 1899, Mr. Denning has conjectured that the earth would first pass in front of and then behind the cluster, thus escaping a very central passage, which might, in that case, however, be expected to occur, with the comet's periodic time of revolution of $6\frac{1}{2}$ years, with near enough exactness for a great display, on November 17th, 1905. But as watches for the *Bielid* star-shower, at the present nodal passage will now no doubt have been kept attentively at many stations well favoured, if not very generally in the British Isles, by clear sky and fair weather for observing both the *Bielid* shooting-stars and other meteors, these recent meteor-notes may perhaps usefully suggest

[1] Referred to in the *Note* on p. 271, as apparently a very important observation of a meteor-shower, from the brightness and very perfect radiation of the meteors, and from the clearness and accuracy of their paths descriptions.

[1] *Astronomische Nachrichten*, No. 3516, September; and *The Observatory*, October 1898.

some trial radiant-points for any remarkable shooting-stars or large meteors of the two past years' expected maximum *Bielid* periods which may have been recorded.

Observatory House, Slough, A. S. HERSCHEL.
December 16th, 1899.

Is New Zealand a Zoological Region?

WILL you allow me to make one remark on the letter of Mr. H. Farquhar (p. 246), advocating an affirmative answer to the above question. It is this: Throughout the whole argument there is an assumption which vitiates it, namely, that the amount of resemblance of the New Zealand fauna to that of *Australia* is what alone determines its resemblance to that of the *Australian Region*.

Apparently, Mr. Farquhar does not believe that New Caledonia and the New Hebrides belong to the Australian Region, otherwise he would not adduce the fact of the land-shells of New Zealand being related to those of the above-named islands as an argument in his favour; and if these are omitted, then must New Guinea be also omitted. And if Australia by itself is to become a "Zoological Region," New Guinea and its surrounding islands must be also a "Region," the Central Pacific Islands another, and the Sandwich Islands yet another! This indicates the difficulties that arise if the Australian Region, as originally defined by Dr. Sclater and myself—and which I still hold to be far more natural than any subdivision can make it—be rejected.

ALFRED R. WALLACE.

Molecular Structure of Organised Bodies.

PROF. VINES, in his "Physiology of Plants," says that the molecular structure of cells can only be inferred from their properties, and that a correct conception of this structure is essential for a proper comprehension of cell growth. In the same work the author also states that Naegeli argues: "Since the optical properties of these organised structures are apparently not dependent, like those of a crystal or a piece of glass, upon the relative position of their constituent particles, they must be inherent in the particles themselves. Each micellæ, then, possess the optical poperties of anisotropic crystals. Naegeli concluded, therefore, that the micellæ are crystals."

Naegeli's micellæ theory rests almost entirely on the failure of any effort to temporarily destroy the anisotropism of organised structure. Obviously, if it were possible to so act on or swell a vegetable fibre that its anisotropism were destroyed, and that this anisotropism returned after the treatment were discontinued, Naegeli's theory, as far as it relates to the optical properties of micellæ, would fall to the ground.

It is well known that organised structures cease to be doubly refractive at the moment when their organised structure is destroyed. This is usually explained by saying the micellæ are at the same time disintegrated.

As far as I am aware, it has never been shown that this property of double refraction, common to organised structures, can be destroyed by suitable swelling, and restored again when the body returns to its original condition. I have been able to do this, in the case of cotton fibre, and it seems to me to give the *coup de grace* to Naegeli's theory.

I take it that if in one instance the anisotropism of organised structure can be temporarily destroyed, it is a correct inference, that to do so in every case only requires a suitable medium; which will reduce the strains to a necessary degree without the destruction of the physical form of the organised structure.

In the course of some investigations on the destruction of nitro-cellulose fibres, by means of solvents, I observed that in one particular case the double refraction disappeared long before the physical structure, and that on getting rid of, or diluting the solvent, the anisotropism returned. It is because I think this observation will be of interest to biologists I am troubling you at length.

It is well known that on converting fibrous cellulose into nitro-cellulose, the fibres retain their optical properties as regards polarised light. Nitro-cellulose, however, has a very wide range of solvents, and the examination of organised fibres when treated with solvent, becomes very extended.

Most nitro-cellulose solvents, such as acetone, nitro-benzene, the ethers, &c., do not lessen the anisotropic properties. The fibres may be swollen to twice their diameter, but still polarise light, until their physical structure is quite gone. This is not so, however, if nitro-cellulose fibres are acted upon with a mixture of acetone, benzene and ethyl alcohol. With this solvent the nitro-cellulose becomes gelatinised, and the anisotropism disappears, yet on examination the fibres are seen to be present in great abundance. These isotropic fibres can be given their double refractive properties again, by diluting the solvent with excess of alcohol or benzene.

The accompanying photographs show this action very well.

Nitro-cellulose was prepared from cotton-wool, with large excess of acids, so that there should be no unnitrated fibres present. The resulting nitro-cellulose was practically all of the

FIG. I.

insoluble variety, and contained 13·3 per cent. nitrogen. It wa completely soluble in excess of acetone, and contained no cotton fibres.

Some of this nitro-cellulose was treated with ten times its weight of a solvent consisting of:

6 parts benzene
3 ,, alcohol
2 ,, acetone

and allowed to stand in a stoppered bottle twenty-four hours, a jelly resulted.

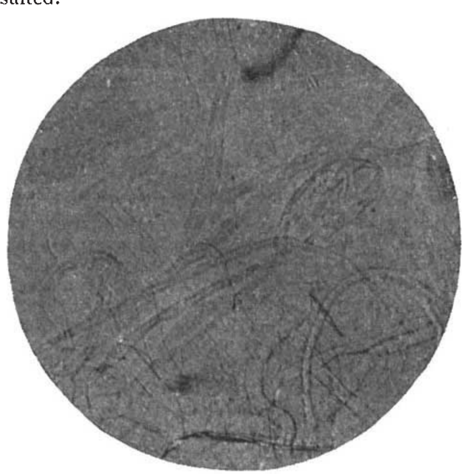


FIG. II.

Figs. I., II. and III. are from a little of this jelly, mounted with two crossed cotton fibres to fix the point of view, and give an object to focus and develop. The three photographs are taken from the same slide and the same point of view.

Fig. I. is a view under crossed nicols of the jelly, and taken immediately after mounting. It will be noticed that the object shifted slightly during exposure.